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PRIMARY INJECTION TEST SYSTEM

Raptor

F1 by SMC
Formula Innovation

SMC
www.smcint.com

The Raptor System

Multifunctional Primary Testing System

The Raptor is a smart test system designed as the ultimate solution for the main primary test applications required in the commissioning and maintenance of substations, marking the difference with respect to existing equipment now being used. This new generation of Primary Injection Test System makes primary testing easier, faster and more convenient.

The system consists of a Master unit which can be upgraded with up to three Slave sets which add further power capacity to the system. The user is not limited to the power initially determined. In case of more power required, Raptor sets can be added, or what is also very important, be left behind when not needed.

In comparison with the big and heavy traditional variac-based equipment, the Raptor is designed incredibly smaller and lighter than its predecessors, combining a revolutionary high current generation technology, DSP based, with an automatic smart control, in a really transportable set, less than 35 Kg and able to inject up to 15,000 A.

An additional advantage to the easy transport is that sets can be much closer to the devices tested, reducing the length of cables, and a significant decrease in power losses by eliminating intermediate connections, thanks to the new loop-through concept. The sets have in the middle a hole to pass through the cables which are connected to the load, forming in this way the injection circuit.

Efficient Power

The modern high-tech design of the Raptor system enables the highest level of injection capability in terms of power and duty cycle, with an ease of use so far unknown in this type of equipment. A touch-sensitive console allows the user to fully monitor and control the test process, including the storage of results and test configuration tools.

The Raptor system provides automatic regulation of the magnitude to be injected, being stable regardless of the load or power supply changes. Current output range is adjusted at all times according to application, taking advantage of the modularity and versatility of the concentration of measurement and control functions in the Raptor Master unit, with a unique capacity to adjust the voltage and current required through the number of spire turns used.

The Raptor also includes a powerful measurement section, extending the number of testing applications.

Raptor system includes factory configured tests, to automatically perform a large amount of the most common testing, just by selecting the appropriate template and start the test. The user has also the possibility to easily make or modify test templates.

UNIQUE FEATURES

- SMALLEST SIZE AND WEIGHT FOR OUTSTANDING PORTABILITY
- AUTOMATIC OUTPUT REGULATION WITH DIGITAL TECHNOLOGY
- MULTIFUNCTIONALITY FOR MOST PRIMARY INJECTION TESTING
- INSTANT COMBINATION OF UNITS BY INFRARED
- LOOP-THROUGH HIGH CURRENT TECHNIQUE
- FLEXIBLE MODULARITY AND ADAPTABILITY
- MODERN, ROBUST AND UPGRADEABLE TECHNOLOGY
- SMART HANDHELD CONTROLLER WITH TOUCH SCREEN
- RESULTS STORAGE AND REPORTING
- PREDEFINED TEST TEMPLATES

The Raptor System: Applications

The Hand Held Control Unit, RAPTOR-HH, is the user-friendly interface from which the operator remotely controls and monitors all the test process. The Raptor HH detects and configures the master and slave units automatically.

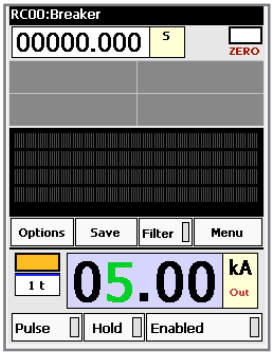
It provides an intuitive TFT touch screen, visible even in direct sunlight, with a wheel-and-click control that combined with the existing test templates makes the test configuration and execution task extremely easy and fast.

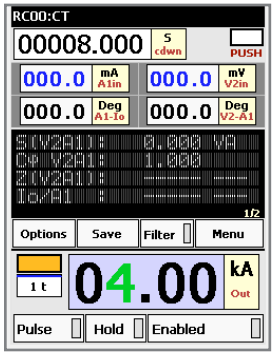
The unit saves all the test configurations and results on its own memory, which can be further downloaded to an external computer through USB connection and the RaptorSync software. This unit only weights 0.4 Kg and it is developed with an ergonomic design optimized for correct handheld use, and nonslip laterals for a safer grip.

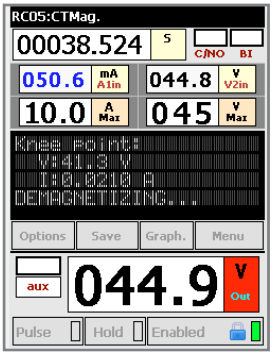
The Raptor HH is connected to the Master through a 5-meter cable that allows the user to stay at a convenient location while the test set is working much closer to the load. For extreme cases, a 4-meter extender is available as an optional accessory. The console's back is magnetized, which allows the user to snap it quickly and safely on any iron surface for a more comfortable operation.

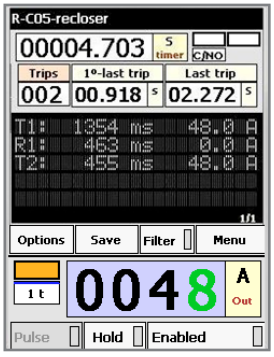
Other advantages are: data storage and reporting, configuration assistance, software upgrades by internet, simplify and reduce testing time, easy touch/turn operation, maximum test accuracy.

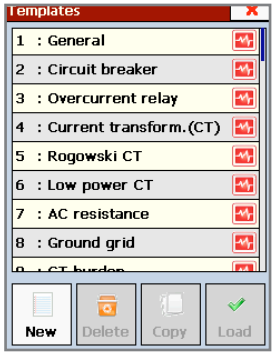
Test Templates allows the user to just select the appropriate template and start the test. Most common tests available are: Overcurrent relay, MCB/MCCB, CT Ratio/Phase/Burden, CT ratio/phase with voltage, VT ratio/burden/phase, Rogowsky CT, PT, contact Resistance, Ground Grid, CT magnetization curve and Knee point, Pulses, Recloser, etc.

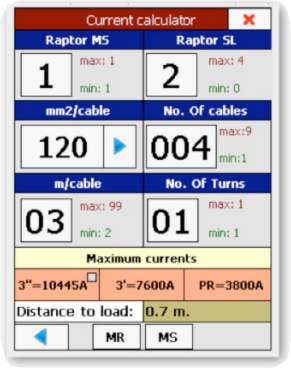












The Raptor Current Calculator is included as standard in the Raptor HH console and can also be installed on a PC. It is a simple to use yet sophisticated tool that allows the user to quickly define the Raptor configuration and the number and type of cables required as minimum to successfully accomplish a specific high current job, even before leaving the office.

APPLICATIONS

The combination of mobility, adaptability, automatic current regulation, high-tech, ease of use and versatility makes the Raptor the best system available in the market for all major primary injection testing applications in and around substations and power plants:

Primary Current Injection Testing

Primary Injection Testing is essential in commissioning and verifying a protection scheme. The secondary injection test does not check all the components in the system, as it cannot provide the condition of the overall protection installation, whether CTs have the correct ratio or polarity, or whether the secondary wiring is correct and serviceable, and it does not mimic the operating conditions in service. Therefore, the Primary injection testing is the only way to prove correct installation and operation of the entire protection scheme, and the Raptor has been specially designed to meet all primary testing needs.

The Raptor´s variable output frequency extends the primary testing diagnostic with frequency sweep, offering test frequencies different from the mains frequency, and thus enhancing its electrical testing capacity. Primary Test involves the entire circuit; current transformer primary and secondary windings, relays, trip and alarm circuits, circuit breakers and all wiring are checked. Primary injection tests are carried out after secondary injection tests, to ensure that problems are limited to the VT's and CT's involved, circuit breakers, plus associated wiring, all other equipment in the protection scheme having been proven satisfactory from the secondary injection tests. Hence it is often the last tests performed in the commissioning and maintenance process, or after major modifications have been carried out, and also as an invaluable aid to faultfinding.

The Raptor System: Applications

Relay Testing

With the Raptor, primary faults can be simulated to check if protective relays operate correctly; trip times are measured and registered by the system, with 1 ms resolution. The automatic current regulation, the pre-set current injection, the injection time control, and the test results storage, provide the user with the most advanced primary testing tool for protection relays.

Circuit Breaker Testing

It is also essential for the verification of the entire protection scheme to verify live CB tripping, and CB operating time analysis in combination with total trip time including the IEDs and CB trip time. Measurements with the Raptor deliver reliable and repeatable results due to high signal and measurement accuracy.

Current Transformer Testing

The Raptor system has many advanced features – such as powerful measurement input, to allow performing a complete check of a CT. Through a few seconds test the following results are obtained: Turns Ratio, phase (polarity) between primary and secondary of the CT, and burden (Impedance, power and power factor of the load). It can be also used for testing low power and Rogowski CTs, checking ratio, phase and burden in VTs, and checking Ratio, Polarity, short circuit impedance and reactance losses in Power Transformers. Test templates are also available for Magnetization curve and “knee point” of a CT.

Recloser and Sectionalizers

Through the high current fault simulation, the Raptor performs automatic test, detecting and getting opening and reclosing times, number of operations, partial and total times, of the recloser under test.

Switchgear Testing

Low voltage switchgear and controlgear assemblies require also high current testing to comply with the relevant product standards, both by assembly manufacturers and users. The Raptor is also suitable for testing the rated short-time current that the assembly must withstand, and MCB/MCCBs tripping time performance, both thermal and short-circuit trips.

Heat Runs

Thanks to the amplifier-based high current generation of the Raptor, it is ideal for performing heat runs, maintaining the current injection stable throughout long-term testing, and measuring the corresponding time.

Polarity Testing

The Polarity Tester is a lightweight handheld accessory used to verify the correct wiring in a quick and simple way, as the Raptor injects a special polarized signal into the primary side of any transformer (CT, VT, PT, etc). This is especially useful for checking polarities in remote connections and/or those with difficult access.

Ground Grid Testing

By injecting high current and measuring with the low level voltmeter it is possible to detect the existence of any bad or eroded contact in the ground grid.

Functionality Updates

The Raptor System will not become obsolete as all functional elements are programmable. We at SMC keep the end users updated with free new updates and applications required by market demands. Furthermore, the Master unit is designed to enable additional functionality with future add-on equipment.

The Raptor System: Benefits

Automatic Output Regulation

DSP technology maintains a uniform current waveform even with changing load impedances and speeds testing by eliminating the manual variac. Every other high current system requires the user to manually set the output current.

It also overcomes heating of the trip elements which caused the current to drop during the test.

Weight and Size

Amazing portability compared to other existing equipment, due to its light weight and small size, that allows one person to carry it, even in his own car. The modularity allows to carry the minimum units to site.

Easier and cheaper to transport and handle. Each unit has wheels and folding handle.

Reduces the length of cables required as sets can be much closer to the device tested.

Facilitates portability into installations with limited space and/or with difficult access, such as stairs, soft soils, underground substations, etc.

Multi-Functionality

The Raptor system concentrates many applications and testing assets, offering a time-saving and cost effective solution.

The Raptor logic system features high-power processors to take care of future requirements, and their functionality can be readily enhanced by means of firmware upgrades through the Internet.

Expandability

The modular design can accommodate several Raptor Slaves to the Master unit, and the user is not limited to initial power requirement, being able to upgrade the system at a modest cost for higher power needs.

Sets are immediately assembled and synchronized thanks to infrared technology connectivity, IRDA type, thus saving time, making the portability even better, and the expandability of the system a simple task.

Loop-through concept

The Loop-through high current secondary concept contributes both with flexible modularity and with lightness and smaller size of the Raptor.

Unique capacity to adjust the voltage and current required through the number of loop turns used.

Reduces cables connection to the minimum possible, thus reducing power losses, and simplifying the test preparation.

Handheld Control Unit (Raptor HH)

Powerful and smart interface with TFT color Touch Screen to control and monitor the test.

Simplify testing through a automating process and test templates, including the storage of test results, and reducing testing time. Simply dial up the desired current and inject.

USB connection to a PC, and through RaptorSync application to download reports for further editing, analysis, storing and printing.

Pre-defined test templates help the user to perform quickly and in a more efficient way the most frequent tests, with minimal training and preparation. Users can also create their own test templates.

Ethernet connector for software updates.

Reliable high speed Raptor Bus connector, with failure detection and alarms.

On screen calculations and magnitudes conversions.

User´s assistance for system configuration, cable selection and testing.

Measurement section

Voltmeter, Ammeter and Low signal Voltmeter inputs, measures AC and DC signals with phase meter incorporated, extending the testing performance.

Binary input, voltage or dry contact, to detect trip commands that define the end of some tests.

Timer of 1 ms resolution, with zero current detection, and also configurable as countdown to limit the injection time.

Based on the internal and hardware measurements, selectable calculated measurements can be shown on screen , such as Total Power, Apparent and Reactive power, Power factor, Impedance, Reactance, Resistance, Transformation Ratio and Ratio Error.

The Raptor System: Features

MASTER UNIT'S FEATURES

The Raptor MS is the master unit of any Raptor configuration. It provides the connection for the touch screen console and can be used as stand-alone for primary test applications that do not require extremely high current/power. When slave units are added, the MS will detect them automatically over the infrared link and will accommodate the system's parameters with no intervention from the user:

- Regulated high AC current output. Able to inject up to 3.8kA (with 3kVA) indefinitely or 9.5kA (with 2kVA) during 3s. Up to 15kA when combined with one or more slave units.
- Regulated AC auxilliary output. Working in current mode is capable of injecting up to 9 A indefinitely or 35A for 3s. Working in Voltage mode is capable of generating voltage up to 200V AC.
- Voltmeter Input. Ranges: 0.2, 2, 20 or 300Vac/dc (auto or manual). Built-in phase angle meter.
- Ammeter input. Ranges: 0.2, 2 or 20Aac/dc (auto or manual). Built-in phase angle meter.
- Low signal Voltmeter. Ranges: 30, 300 or 3000 mVac/dc (auto or manual). Built-in phase angle meter.
- Binary input: Voltage or dry contact with reversible logic (NO, NC) and auto-detection.
- LEDs: Monitor overload, temperature, status of communications, standby, digital input, power output and power supply.
- IRDA interface: Interconnects Slave units to the Master wirelessly.

SLAVE UNIT'S FEATURES

The Raptor SL features toroidal windings that are activated individually by the master unit as the power demand grows, through a sophisticated injection control that ensures seamless current flow and optimal workload distribution.

The slave Raptor is visually identical to the master unit but lacks the measurement section, the handheld controller and the auxiliary input/output panels. Its mission is to push an additional 5 kVA power to the high current pass-through secondary. Up to three slaves can be added for up to 15,000 A with a 18-kVA total injection power. The master unit detects the presence of slaves using infrared communications, so no additional control or power interconnections are required. The user only needs to pass the current cables across the entire assembly and use it as if it was a single device, in a fully transparent way to the user. As an added benefit of the pass-through secondary technique, the user can easily multiply the compliance voltage by making more than one turn with the current conductor around the entire system.

The Raptor System: Specifications

RAPTOR-MS

(values @240 Vac, 50 Hz, 1 turn sec. 960 mm², measured 25 cm on each side)

HIGH CURRENT OUTPUT	
Output Current	Output Voltage
No Load V (0%Imax)	0 - 1.20 Vac - Continuous
3.8 KAac (25%Imax)	0 - 0.81 Vac - Continuous
7.5 KAac (50%Imax)	0 - 0.42 Vac - 3 min
9.5 KAac (Imax)	0 - 0.22 Vac - 3 s
No Load Resolution	25 uVac
Output Frequency	20 - 400 Hz (Power reduction applied at 50 > f > 60 Hz)
LOW CURRENT OUTPUT (not simultaneous with high current output)	
Output Current	0 - 35 Aac (0 – 9 Aac continuous)
Voltage Output	0 - 200 Vac
Output Frequency	20 - 400 Hz (Power reduction applied at 50 > f > 60 Hz)
Isolated output	Yes
Protection	fuse
MEASUREMENTS	
Secondary Current	(for high current output)
Ranges	0-1 KAac/N; 0-15 KAac/N (n: number of secondary turns)
Resolution	1 Aac, 10 Aac
Accuracy	±0.2% of the value ±0.2% of the range
Phase angle	±0.25°
AMMETER/LOW LEVEL VOLTMETER	
Ammeter Ranges	0 - 0.2 / 0 - 2 / 0 - 20 Aac
Ammeter Resolution	0.1 mAac, 1 mAac, 10 mAac
Ammeter Impedance	<10 mΩ
Voltmeter Ranges	0 - 30 mVac, 0 - 0, 3 Vac, 0 - 3 Vac
Voltmeter Resolution	0.015 mVac, 0.15 mVac, 1.5 mVac
Voltmeter Impedance	>3000 KΩ
Frequency range	20 - 400 Hz
Accuracy	±0.1% of the value ±0.1% of the range
Phase angle	±0.25°
Isolated input	Yes
VOLTMETER	
Ranges	0 - 0.2 / 0 - 2 / 0 - 20 / 0 - 300 Vac
Resolution	0.1 mVac, 1 mVac, 10 mVac, 0.15 Vac
Impedance	>120 KΩ
Frequency range	20 - 400 Hz
Accuracy	±0.1% of the value ±0.1% of the range
Phase angle	±0.25°
Isolated input	Yes
BINARY INPUT	
Type	Dry contact / Voltage
Voltage mode Levels	1.5 V, 15 V
Time resolution	1 ms
Max. Voltage	250 Vac
Isolated input	Yes
COMMUNICATIONS	
2 RS-485	Raptor Bus connectors to control unit Raptor-HH and/or other units
2 IrDA interfaces	Two channels for master/slaves linking
GENERAL	
Supply	230 V ±10%, 50/60 Hz (single phase)
Weight	35 Kg / 77 lb
Dimensions	550 x 440 x 230 mm / 21 ½" x 17 ½" x 9"
Protections	MCB, overload, temperature, supply, communications, polarity
Sec. hole diameter	85 mm
Transport	Wheels, folding handle, fixed handle

RAPTOR-SL

(values @240 Vac, 50 Hz, 1 sec.turn 960 mm², measured 25 cm on each side)

HIGH CURRENT OUTPUT	
Output Current	Output Voltage
No Load V (0%Imax)	0, 0.79 or 1.59 Vac - Continuous
3.8 KAac (25%Imax)	0, 0.67 or 1.34 Vac - Continuous
7.5 KAac (50%Imax)	0, 0.55 or 1.11 Vac - 3 min
15 KAac (100%Imax)	0, 0.30 or 0.61 Vac – 3 s
COMMUNICATIONS	
2 IrDA interfaces	Two channels for master/slaves linking
GENERAL	
Supply	230V ±10%, 50/60 Hz (single phase)
Weight	35 kg / 77 lb
Protections	MCB, overload, temperature, supply, communications, polarity
Sec. hole diameter	85 mm / 3 ½"
Transport	Wheels, folding handle, fixed handle

RAPTOR-HH

CONTROL	
Display	Transflective high definition color TFT with resistive Touch Panel
Wheel	Rotary Encoder (Wheel and click)
LEDs	Alarm, Connectivity, Power
COMMUNICATIONS	
RS-485	Raptor BUS Communication with Raptor-MS
USB	Connection to PC (RaptorSync)
RJ-45	Ethernet for software updates
	Mini-PC powered by Windows CE
GENERAL	
Power Supply	Self-powered from Raptor-MS, or with external power adapter 5 Vdc
Weight	0.4 Kg / 1 lb
Dimensions	110 x 185 x 35 mm / 4" x 7" x 1 ½"
Case	High quality injection-moulded ABS, strong and ergonomic design, edge surfaces protected with TPE non-slip material. Magnetic base.
Compliance	The instrument is intended for use in high-voltage substations and industrial environments. All EuroSMC products have conformity to CE-marking directives, complies with IEC and international standards, and are designed and manufactured in accordance with the requirements of the ISO-9001 Quality Standard
Transport Bag	Nylon soft bag
Connection cable	5 m cable / 16 ½ ft cable

The Raptor System: Options

Nº sec. turns	Compliance Voltage (V)				Max. Current (A) Continuous	Max. Current (A) 3 minutes	Max.Current (A) 3 seconds
	RAPTOR C-05	RAPTOR C-15	RAPTOR C-25	RAPTOR C-35			
1	1.20 - (0.22)	2.79 - 0.26	4.39 - 0.87	5.98 - 1.48	3,800 @ 0.81 / 2.15 / 3.50 / 4.84 V	7,500 @ 0.42 / 1.53 / 2.63 / 3.73 V	(9,500) 15,000 @ (0.22) / 0.26 / 0.87 / 1.48 V
2	2.40 - (0.33)	5.59 - 0.52	8.78 - 1.73	11.96 - 2.95	1,900 @ 1.61 / 4.30 / 6.99 / 9.68 V	3,800 @ 0.83 / 3.02 / 5.21 / 7.40 V	(5,000) 7,500 @ (0.33) / 0.52 / 1.73 / 2.95 V
3	3.60 - (0.45)	8.38 - 0.77	13.16 - 2.60	17.94 - 4.43	1,267 @ 2.42 / 6.45 / 10.49 / 14.52 V	2,500 @ 1.27 / 4.58 / 7.88 / 11.19 V	(3,800) 5,000 @ (0.45) / 0.77 / 2.60 / 4.43 V
4	4.80 - (0.66)	11.18 - 0.90	17.55 - 3.28	23.93 - 5.66	950 @ 3.23/8.61/13.98/19.36 V	1,900 @ 1.66/6.04/10.42/14.79 V	(2,500) 3,800 @ (0.66)/0.90/3.28/5.66 V
5	6.00 - (1.09)	13.97 - 1.29	21.94 - 4.34	29.91 - 7.38	760 @ 4.04/10.76/17.48/24.20 V	1,500 @2.12/7.63/13.14/18.64 V	(1,900) 3,000 @ (1.09)/1.29/4.34/7.38 V

ORDERING INFORMATION

SYSTEM CONFIGURATION	
RAPTOR C-05	1 x Raptor-HH + 1 x Raptor-MS
RAPTOR C-15	1 x Raptor-HH + 1 x Raptor-MS + 1 x Raptor-SL
RAPTOR C-25	1 x Raptor-HH + 1 x Raptor-MS + 2 x Raptor-SL
RAPTOR C-35	1 x Raptor-HH + 1 x Raptor-MS + 3 x Raptor-SL

ACCESSORIES INCLUDED

RAPTOR-HH	
	Hand held console with software
	Stylus
	Nylon Bag
	System Cable, 5 m
	USB cable
	Ethernet cable
	Universal Power adapter
	User's Manual
RAPTOR-MS	
	Raptor Master Unit
	Power Supply Cable, 3 m
	Low-level voltmeter cable, 2 m
	Connection cables set
	Spare fuses
	Set of alligator type clips
	Nylon protective bag
	Calibration Certificate
RAPTOR-SL	
	Raptor Slave unit
	Power Supply cable, 3 m
	Spare fuses
	Nylon protective bag

OPTIONAL ACCESSORIES

Ultra-flexible high current cables	These copper braid, silicon coated 120 mm2 cables, thanks to its ultra flexibility allows to squeeze the highest performance of the Raptor System, especially when using the multi-turn technique.
CBL3M-RAP	120 mm^2 cross section and 3 meters (9 ft) long
CBL6M-RAP	120 mm^2 cross section and 6 meters (18 ft) long
CBL9M-RAP	120 mm^2 cross section and 9 meters (27 ft) long
RAP- ACC1	Multi cable terminal up to 4 cables
RAP- ACC2	Multi cable terminal up to 6 cables
RAP-HCC	Pair of High Current Clamps
CBL-HH4M-RAP	4-meter (12 ft) extender for Raptor HH
RAP-PT	Polarity Tester
TC-03	Sturdy ABS transport case with wheels and extensible handle

Please note: Due to the continuous research and development by EuroSMC, specifications in this catalog may be changed without previous notice.
KAACCEN - Version 3

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